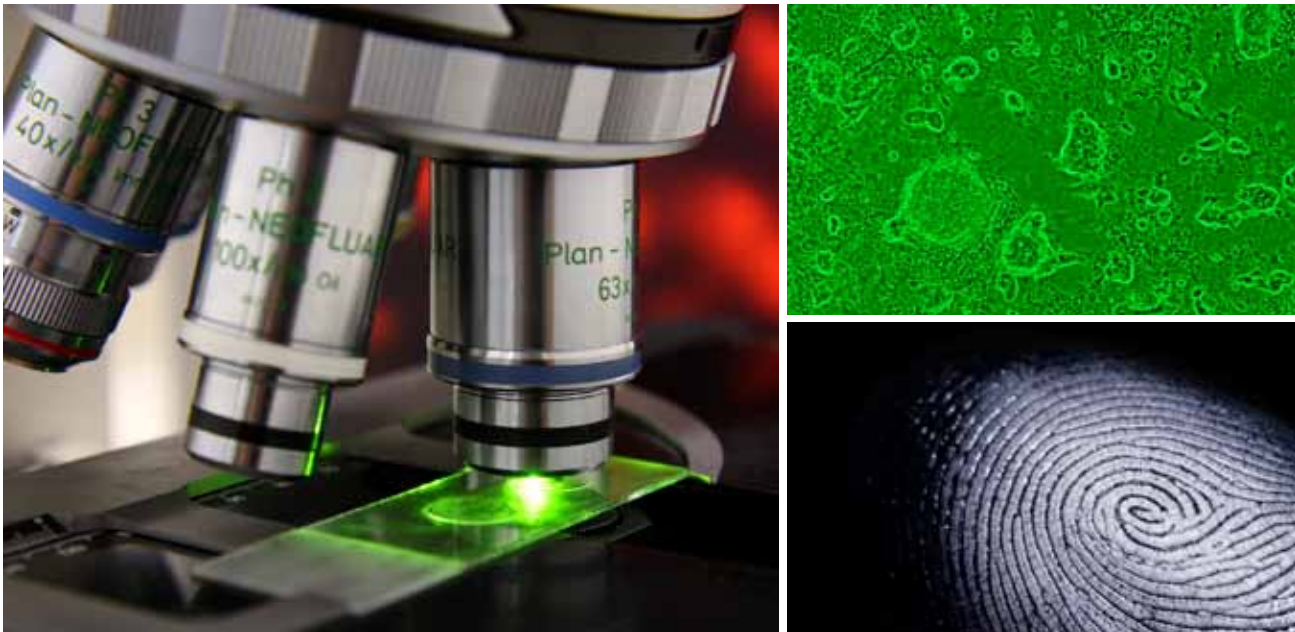


technology opportunity

A Compact Microscope Imaging System with Intelligent Controls

Automating tasks with accuracy and repeatability



Innovators at Glenn Research Center have developed a diagnostic microscope analysis tool with intelligent controls. This compact microscope imaging system (CMIS) combines intelligent image processing with remote control capabilities usually reserved for conventional microscopes. The innovation can be used *in situ* with a minimum amount of user intervention. It incorporates the ability to autofocus on a microscope sample, automatically scan an image, and perform machine vision analysis on multiple samples simultaneously. The hardware requires less room than conventional microscopes, and experiments can be conducted without the need for constant monitoring. The system runs, controls, and analyzes microscope experiments automatically and remotely.

www.nasa.gov

Benefits

- **Adaptable:** Uses off-the-shelf hardware and adaptive neural network machine vision algorithms to produce a turn-key automated system optimized for customer applications
- **Unique:** Integrates a machine vision technique with an instrumentation and control technique
- **High Resolution:** Detects and tracks microscopic changes in cells and surfaces
- **Integrated Software:** Provides an array of standard diagnostic tools for feature extraction and object identification
- **Precise:** Offers improved analytical techniques for interface detection in colloidal hard sphere systems, cell identification and classification, and surface defect classification
- **Automated:** Monitors quality control where human visualization of the surface is difficult

Applications

- **Automated in-line inspection of precision manufacturing operations**
- **Biomedical imaging**
- **Fingerprint identification**
- **Remote examination of soil and water samples**
- **Automated blood and cell analysis**
- **Microscopy (crystal growth patterns, patch clamping, cell movement, and tracking)**

Technology Details

How It Works

The system includes a miniature video microscope, a Cartesian robot, and machine vision and control subsystems which include adaptive neural networks that afford a measure of artificial intelligence. The CMIS automatically focuses on and scans a microscope sample, finds areas of interest, records the resulting images, and analyzes images from multiple samples simultaneously. For automatic focusing, the translation stage moves the microscope along its optical axis in a succession of coarse, medium, and fine steps. A fast Fourier transform (FFT) of the image is computed at each step, and the FFT is analyzed for its spatial-frequency content. The microscope position that results in the greatest dispersal of FFT content toward high spatial frequencies (indicating that the image shows the greatest amount of detail) is deemed to be the focal position. In addition to automatic focusing, the CMIS is capable of performing the following other functions: adaptive thresholding, auto-imaging scanning, identification and classification of objects, motion detection, and transition mapping.

Why It Is Better

Glenn's CMIS offers in a small, lightweight, compact form, functionality previously available only in large bulky instruments. Innovative software processing techniques offer improved diagnostic techniques in multiple areas, such as interface detection in colloidal hard sphere systems, cell identification and classification, and surface defect classification. Unlike human technicians, the CMIS will not tire or become distracted. The innovation is especially useful in inspecting parts on industrial production lines, biomedical research, materials science, and space science in its capabilities for remote control and for relieving human technicians of tedious tasks.

Patents

Glenn has patented this technology (U.S. Patent Nos. 7,268,939; 7,106,502; 7,042,639).

Licensing and Partnering Opportunities

Glenn's Technology Transfer and Partnership office seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to discuss partnership opportunities for this compact microscope imaging system technology (LEW-17484-2,3,5) for commercial applications.

For More Information

For more information about this and other technology licensing opportunities, please visit:

Technology Transfer and Partnership Office
NASA's Glenn Research Center
E-mail: ttp@grc.nasa.gov
Phone: 216-433-3484
<http://technology.grc.nasa.gov>